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Remarks

Thorough examination by the Examiner is noted and appreciated.

The claims have been amended to more clearly claim Applicants invention. Support for the amended and newly drafted claims is found in the original claims and/or the Specification. No new matter has been added. For example support for the limitation uppermost top surface is found in the Figure 4 and in the Specification.

Further support is found in the Specification at paragraphs 0008, 0009, 0036 and 0037:

"The end effector is often damaged by bumping into the wafer cassette or the wafer itself resulting in the end effector finger extensions being broken off."

"Thus it would be desirable to provide a wafer handling system that would be able to accommodate component **locations that are mis-programmed** into the wafer handling controller, changes in the location of the robotic arm, end effector or other processing components due to wear, settling, or malfunction in the same without resulting in damage to the wafer processing components including the end effector."

"To avoid damage to the end effector as a result of the errors in the programming of the various locations of the robot arm, end effector, wafer cassette and various processing locations, wear on the equipment, settling of

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the equipment, or malfunction, the end the fingers 40 extending from the main body portion 38 of the end effector 34 includes tapered tips 54."

"The increase in thickness of the wafer fingers 40 of the end effector 34 further decreases the likelihood of the fingers 40 from being broken off if the fingers 40 accidentally striking the wafer processing equipment or wafer 52."

**Claim Rejections under 35 USC 103(a)**

1. Claims 1 and 4-13 stand rejected under 35 USC 103(a) as being unpatentable over Shamlou et al. (US 6,024,393) in view of Chen et al. (US 5,906,469).

Shamlou et al. disclose substrate handling blade formed of a dielectric abrasion resistant upper surface to reduce particulate contamination caused by rubbing between the substrate handling blade and a semiconductor substrate (see Abstract). In particular, Shamlou et al. disclose a **top plate** of the substrate handling blade (e.g., finger) having an **upper surface** (item 101 in Figure 2). Shamlou et al. teach forming (bonding) a front shoe (free end) and a **back shoe onto the upper surface** of the top plate (items 116 and 120 in Figure 2; col 6, lines 46-50; col 10, lines 38-47). Shamlou et al. teach that the front shoe has a tapered leading edge (item 114 in Figure 2; col 8, lines 50-53; col 10, lines 62-64) extending from the flat portion of the upper

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surface of the shoe towards the bottom surface of the shoe having an angle of about 10 to about 30 degrees. Shamlou et al. teaches that for a particular wafer diameter the thickness of the front shoe is about 1.3 mm. Shamlou et al. do not disclose a particular thickness of the distance between the top plate and bottom plate of the blade, but disclose operation of the wafer handling blade in connection with a prior art wafer holding cassette (figure 2PA) to disclose operation of the apparatus in connection with a batch heating cassette where the wafers are supported on heating supports (item 30, Figure 2PA; col 7, lines 64-67) where the heating supports are positioned on heating shelves (item 33, Figure 2PA) between adjacent wafers. Shamlou et al. do not disclose a spacing between the support shelves and the wafer.

Thus, Shamlou et al. do not disclose several aspects of Applicants disclosed and claimed invention including:

"an end effector having a base portion and at least one finger extending from the base portion, the finger having an **uppermost top surface** and a bottom surface to define the finger including a free end;

wherein the **uppermost top surface** includes a substantially flat portion extending from the base portion, and wherein the finger includes a **tapered portion extending from the substantially flat portion towards bottom surface to define the free end;**"

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In addition Shamlou et al. do not disclose "an opening defined between adjacently positioned wafers in the wafer cassette housing", or a desired thickness of the blade with the shoe on the top surface, nor recognize the problem that Applicants have recognized and solved by their claimed invention:

An apparatus for transporting a semiconductor wafer to or from a wafer cassette housing **with increased resistance to breaking upon misalignment"**

On the other hand, Chen et al. disclose a flat tapered blade for handling wafers having front and rear arcuate abutment surfaces to prevent damage to wafers in the event of misalignment (see abstract). The blade has a depressed surface (lower than the free end) between the front and rear arcuate abutment surfaces that prevents the wafer from contacting the blade (col 2, lines 60-67). The taper of Chen et al. is between a width of the back end and a width of the free end (col 3, lines 16-18). Chen et al. teach a maximum thickness of the blade of 1.5 mm and a wafer spacing of 4.76 mm, thus disclosing a wafer blade having the very problem that Applicants have recognized and solved by their claimed invention.

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Nowhere do Chen et al. suggest or disclose the desirability or benefits of a thicker blade, but merely mentions that the material of suitable strength should be used, and that the dimensions of the wafer blade may be altered **in response to the diameter of the wafer** (e.g., col 3, lines 5-16), clearly referring to the dimensions of the blade **wafer support surface** (see Fig 2, items 26, 28; col 3, lines 33-37) to accomplish proper operation of the structure in wafer handling.

There is no apparent motivation to combine the teachings of Chen et al. and Shamlou et al. since very different wafer blade structures designed overcome different problems are presented. The combination of the references would destroy the principal of operation of the blade structures of either reference. For example the thickness of the front and back shoes alone of Shamlou et al. (1.3 mm) are about the same width as the thickest portion of the blade of Chen et al. Nevertheless, assuming *arguendo* a proper motivation for combination, such combination does not produce Applicants disclosed and claimed invention, or recognize or solve the problem that Applicants have recognized and solved by their claimed invention.

"If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification." *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

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"If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious." *In re Ratti*, 270 F.2d 810, 123, USPQ 349 (CCPA 1959).

"A prior art reference must be considered in its entirety, i.e., as a whole including portions that would lead away from the claimed invention." *W.L. Gore & Associates, Inc., Garlock, Inc.*, 721 F.2d, 1540, 220 USPQ 303 (Fed Cir. 1983), *cert denied*, 469 U.S. 851 (1984).

2. Claims 14 and 17 stand rejected under 35 USC 103(a) as being unpatentable Oka et al. (US 5,906,469) in view of Shamlou et al. (US 6,024,393).

Oka et al. discloses a substrate (wafer) cassette holder having a light sensor to detect a vertical positional range of a substrate spacing in the cassette holder. The wafer handling blade, similar to the wafer handling blade structure of Shamlou et al. has a thick plate portion (rear) shoe at its rear end and a protrusion (front shoe) at its free end (see items 5a and 5c in Figure 5B; col 7, lines 22-30). In addition Oka et al. disclose a method for positioning the wafer blade with respect to a spacing between wafers in the cassette, such that depending on the clearance between the wafers (opening between adjacently positioned wafers), the bottom surface of the conveyance arm is set at **predetermined position above a lower wafer** (e.g., col 9,

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lines 40-59). Thus, Oka et al., teaches a wafer blade similar to Shamlou et al., at a fixed thickness of 2.5mm, having a front shoe, but without a tapered portion, and teach a method for positioning the blade with respect to the spacing between the wafers at a predetermined height above a lower wafer to avoid wafer damage (col 10, lines 58-60).

Thus, Oka et al., in combination with Shamlou et al., do not disclose or produce Applicants wafer blade structure including an uppermost top surface, or Applicants disclosed tapered free end, or Applicants wafer blade thickness. Moreover, neither Oka et al. in combination with Shamlou et al. do not disclose Applicants inherent clearance based on claimed thickness of the blade (extension) (about 0.05-0.2 mm less than the opening). Rather, Oka et al. in combination with Shamlou et al., teach away from Applicants disclosed and claimed invention by teaching a protruding shoe at the free end and teaching a predetermined thickness of the blade (extension). In addition, Oka et al., in combination with Shamlou et al., fail to recognize or teach a solution to the problem that Applicants have recognized and solved by their disclosed and claimed invention.

"A *prima facie* case of obviousness may also be rebutted by showing that the art, in any material respect, teaches away from the claimed invention." *In re Geisler*, 116 F.3d 1465, 1471, 43 USPQ2d 1362, 1366 (Fed. Cir. 1997).

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"A prior art reference must be considered in its entirety, i.e., as a whole including portions that would lead away from the claimed invention."

*W.L. Gore & Associates, Inc., Garlock, Inc., 721 F.2d, 1510, 220 USPQ 303 (Fed Cir. 1983), cert denied, 469 U.S. 851 (1984).*

Since the cited references, alone or in combination, are insufficient to make out a *prima facie* case of obviousness with respect to Applicants independent claims, neither has a *prima facie* case been made out with respect to Applicants dependent claims.

The claims have been amended to clarify Applicants' disclosed and claimed invention and place the claims in condition for allowance. A favorable consideration of Applicants' claims is respectfully requested.

Based on the foregoing, Applicants respectfully submit that the Claims are now in condition for allowance. Such favorable action by the Examiner at an early date is respectfully solicited.



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In the event that the present invention as claimed is not in condition for allowance for any reason, the Examiner is respectfully invited to call the Applicants' representative at his Bloomfield Hills, Michigan office at (248) 540-4040 such that necessary action may be taken to place the application in a condition for allowance.

Respectfully submitted,

Tung & Associates

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